

REMARKS

Favorable reconsideration and allowance of all pending claims are respectfully requested for the reasons indicated in detail below. These claims are believed to define patentable subject matter.

Claim 1 has been amended to incorporate the limitation contained in claim 5. Claims 5 and 14 have been canceled.

Claims 1-6, 8-11 and 13-14 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Sechrist et al. (US 6,117,809) in view of Castagnos, Jr. et al. (US 4,430,201) and Ruettinger et al. (US 2002/0147103).

By way of review, the present invention is a process for the production of high purity hydrogen containing essentially no carbon monoxide from a catalytic reformer. The catalytic reformer has at least one reforming zone wherein the catalyst is continuously moved downwardly through the reforming zone. Fresh or regenerated reforming catalyst is introduced into the top of the reforming zone to replace spent reforming catalyst which is removed from the bottom of the reforming zone. The downwardly moving flow rate of reforming catalyst is established at a rate to produce a net hydrogen product stream containing carbon monoxide and thereafter, the flowing rate of the reforming catalyst through the reforming zone is reduced to subsequently produce a net hydrogen product having a significantly reduced concentration of carbon monoxide.

The '809 reference discloses a process for a catalytic reforming process having three catalytic reforming zones. The '809 reference also discloses a method for recovering chlorine containing species from an outlet stream of a reduction zone, located above the three reforming zones, in which the catalytic metal of a chloride containing catalyst is reduced. The gaseous outlet stream from the reduction zone is passed to a sorption zone which contains catalyst which is maintained at sorption conditions. The sorption zone is located below the three catalytic reforming zones. The catalyst in the sorption zone sorbs the chlorine containing species from the reduction zone outlet stream. This method captures and retains within the process the chlorine containing species that would otherwise be lost from the process that would need to be replaced by the

injection of makeup chlorine containing species. In the Examiner's communication, the sorption zone is incorrectly referred to as "a second catalytic zone." It is also to be noted that a reduction zone is located above and upstream of the three reforming zones. The '809 reference fails to disclose a process to produce a net hydrogen product stream containing extremely low levels of carbon monoxide wherein the concentration of the carbon monoxide in a net hydrogen product stream is determined and then the flow rate of the reforming catalyst passing through the reforming zone(s) is reduced to thereby reduce the concentration of carbon monoxide in the net hydrogen product stream.

The '201 reference discloses a method for the regeneration of coked catalyst resulting from a hydrocarbon conversion reaction in which catalyst regeneration is carried out in a plurality of superposed regeneration zones comprising the combination of a first dense phase fluidized bed regeneration zone, and an entrained catalyst dilute phase regeneration zone superposed on the first regeneration zone, and a second dense phase fluid bed regeneration zone superposed on the dilute phase regeneration zone. The catalyst is regenerated by the combustion of coke from the surface of the catalyst at an elevated temperature in the range of 675°C - 800°C with an excess of oxygen supplied by an oxygen containing regeneration gas part of which is introduced into the first fluidized bed regeneration zone and another part is introduced into the dilute phase regeneration zone, including a means of control of the rate of catalyst recirculated from the second dense phase regeneration zone to the first regeneration zone. The '201 reference discloses a method for the combustion of coke from a spent catalyst containing coke resulting from a hydrocarbon conversion reaction. The combustion of coke is conducted at a temperature in the range of 675°C - 800°C (1250°F - 1470°F) in order to substantially complete the combustion of coke thereby resulting in a regenerated catalyst. The resulting effluent from the combustion of coke is nitrogen, oxygen, carbon dioxide and not more than 500 ppm carbon monoxide. In marked contrast, the present invention is a process for the catalytic reforming of a naphtha hydrocarbon stream to produce high octane gasoline at a temperature of 454°C - 538°C. The resulting effluent from the reforming zone contains high octane liquid hydrocarbons, normally gaseous hydrocarbons, hydrogen and in some cases

carbon monoxide. In marked contrast, the effluent from the reforming process of the present invention does not contain oxygen, nitrogen or carbon dioxide. In the '201 reference the reason for minimizing the concentration of carbon monoxide in the effluent is to ensure that the coke is completely removed from the spent catalyst by complete combustion thereof. In contrast, the present invention is not combusting coke and only generates carbon monoxide as an unintended component in the net hydrogen effluent stream. In light of the hereinabove described differences, the applicants respectfully submit that a person skilled in the art would not select the '201 reference to modify the '809 reference in order to arrive at the process of the present invention.

The '103 reference discloses a process wherein a hydrocarbon and water are introduced into a hydrocarbon reformer reactor to produce a stream comprising carbon monoxide and water. This resulting carbon monoxide containing stream is introduced into a water-gas shift reactor wherein the carbon monoxide and water react to produce carbon dioxide and hydrogen. The primary thrust of the '103 reference is to disclose a copper based catalyst containing a low concentration of platinum group metals which catalyst is suitable to catalyze the water-gas shift reaction. This process is for the conversion of on-purpose carbon monoxide to produce hydrogen. The carbon monoxide conversion in the outlet stream is measured for the purpose of determining the activity of the catalyst. In accordance with the present invention, the carbon monoxide generation in the reforming zone is an undesired product. In contrast, the measurement of carbon monoxide in the present invention is to determine the required change in flow rate of the reforming catalyst passing through the reforming zone. Based upon the hereinabove discussion, the applicants respectfully submit that the '103 reference would not be an incentive to a person skilled in the art to modify the '809 reference.

Since based upon the hereinabove discussion, the applicants respectfully submit that the Examiner has failed to promulgate a *prima facie* case of obviousness and, therefore, strongly disagree that the combined teachings of the three references inherently teach the limitation wherein a neat hydrogen product stream contains from 0.1 – 20 ppm carbon monoxide.

The Examiner states that the '809 reference fails to teach a liquid hourly space velocity from about 0.5 to about 4 hr⁻¹. The Examiner asserts that the '809 reference teaches wherein the flow rates of the reduction outlet gas streams are adjusted for the purpose of acquiring the desired temperature. The Examiner's attention is directed to the fact that the liquid hourly space velocity refers to the travel of the hydrocarbon feed through a reforming zone and not the gaseous flow rate through the reduction zone. A careful reading of the '809 reference will show that the reduction zone is separate from the catalytic reforming zone. Based upon the above, the Examiner's explanation of an artisan's motivation is, therefore, incorrect.

Claims 7 and 12 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Sechrist et al. (US 6,117,809) in view of Anumakonda et al. (US 6,221,280).

The '280 reference discloses a method of processing heavy hydrocarbon fuels in the substantial absence of steam through catalytic partial oxidation. The feed is partially oxidized by a catalytic reaction occurring at a temperature greater than 1050°C while producing essentially complete conversion of the hydrocarbons to hydrogen and carbon monoxide. The purpose of this process is to produce on-purpose hydrogen and carbon monoxide. In marked contrast, the process of the present invention is the catalytic reforming of a hydrocarbon feedstock to produce high octane gasoline and a net hydrogen product stream containing essentially no carbon monoxide.

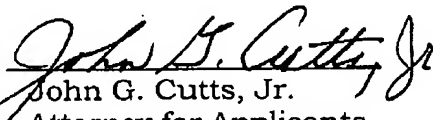
The fact that individual components can be found in the prior art and rearranged to provide the benefits of a novel catalytic reforming process is not a proper basis for an obviousness rejection. There must be something more in the art to suggest the modification of the cited references than obtaining the benefit that the applicants have discovered. One of ordinary skill in the art would not know the advantages that have been discovered by the applicants and described in the specification of the present application. The mere application of broad principles or goals is insufficient to provide the missing motivation or suggestion to the *prima facie* case. The use of scientific principle alone has been specifically rejected as sufficient to support a *prima facie* case of obviousness where the prior

art does not suggest desirability of the modification. Moreover, widely known and simple components when integrated into a beneficial invention are not obvious despite the means with which the components may have been integrated if one skilled in the art recognized the benefit of the integrations.

Based upon the hereinabove discussion, the applicants respectfully submit that the rejection of claims 1-14 under 35 U.S.C. 103 is not supported by a *prima facie* case of obviousness and should be withdrawn in view of the degree of disassembly and altered reconstruction of the prior art required to construct the applicants' invention. The applicants respectfully submit that the Examiner has cited no prior art references, either alone or in combination, which disclose, teach or suggest the integrated essential features of the present invention.

In view of the hereinabove discussion, it is respectfully submitted that all of the pending claims are allowable over 35 U.S.C. 103 and that the application is in condition for allowance. Favorable reconsideration and allowance of the pending claims are therefore courteously solicited.

Respectfully submitted,
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